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WELLE MIT MITTELS SCHWEISSUNG MIT IHR
CONNECTED PART invention relates to shaft along on their mounted and fixed corotating member, whereby the shaft is at least in the region, becomes mounted in which the member, cylindrical, and the member exhibits a cylindrical seating surface and at least a surface lain transverse to the seating surface, and whereby the Schweissting in between the seating surface the shaft and the surface of the element formed groove made lain transverse to the seating surface. With region the attachment point of the element and their environment is in at least a longitudinal direction meant.

The shaft can be a drive shaft, a gear shaft, a crankshaft, a cam shaft or a balancer shaft of a piston engine, the corotating member thus any flange, a wheel or a gear, a part of a clutch, a cam or a balance weight. In particular intended at shafts, which run with high speed and to therefore the high demands regarding, is accuracy and cyclic testing provided become.

Such shafts consist usually of a heat treatable steel or a case-hardened steel, the members often of a case-hardening steel and/or. a case-hardened steel and/or Schmiede Feingussoder are Sinterteile.

For the corotating part favourable and prefered materials are steels with a carbon content of bottom 0.45% or cast iron and/or.

Nodular cast iron, whereby those consists matrix of the basic structure at least of 40% ferrite, remainder perlite, martensite or intermediate stage structure (bay rivet).

With such matings it was a faith article up to now that one direl < : width unit Schweissverbilldtmg in particular refrained by arc welding-avoided will must, from special solutions bottom use from friction welding or laser welding. But there are two reasons: First of all the heating of the shaft leads the cyclic testing affected to their delay, that; Secondly tears, those develop the fatigue strength lower and/or at the beginning and/or end of the weld bead. to the imminent rupture lead. Developing the tears explained itself among other things with the fact that structure and breakdown of the arc are not synchronizable with that melt opens the sweat.

It is thus object of the invention, such matings of a direct weld to make in particular arc weld accessible.

Shaft and member are to become so welded that a continuousfixed connection without impairment of accuracy, cyclic testing or fatigue strength develops.

That a weld bead at a starting point of the surface lain transverse to the seating surface begins, the groove the guided achieved thereby becomes according to invention and then again an endpoint on the surface guided lain transverse to the seating surface is. Anfangs-und endpoint of the weld bead are appropriate thus off the more sensitive part, mostly for the shaft.

On the crosswise located surface at least in the zone of this surface element disturb Anfangs-und/or Endkrater of the weld bead did not stress less. Their interconnecting part lies then in the groove.

The weld bead can follow, does not have however not, the whole periphery of the shaft; it can remain on a part or on several parts of the extent circle limited. The favourable case of load of a very slender and short weld bead permitted in such a groove mounted weld seam. Thus and by the particular shape of the weld bead the warm entry does not remain small and the shaft twists itself.

Depending upon layer of the surface lain transverse to the seating surface various forms of the weld bead are favourable. If the surface is essentially oh-normal transverse to the seating surface of the shaft, the weld bead in a curvature is guided to the groove, follows this over an elbow part and is then again with a curvature to the endpoint guided in a first variant (claim 2). By the fact is ensured that the weld bead with constant velocity becomes drawn. If it would make a corner, the residence time of the arc would be more prolonged and the local heating of the workpiece larger at this. In a second variant the weld bead rectilinear from the starting point to the endpoint guided and concerned between them the groove (claim 3) is. This is particularly light producible, saves hour of delivery and secures constant welding speed. Paths of the width of the weld bead detected this length finite despite the guide on the straight one an arc.

If the surface is essentially transverse to the seating surface of the shaft oh savings allele, the weld bead of the starting point is in a curvature guided to the groove and again to the endpoint (claim 4). In a variant the weld bead from the starting point is guided to the endpoint in an arc concerning the groove (claim 5).

With oh savings alleles surfaces can be these also multiple and in same angular distances over the circumference distributed, whose forms each groove female with the shaft a weld bead (claim 6).

The good fatigue strength of a so designed connection allowed it, and after struts as smaller as possible and only local heating makes it worthwhile, in development of the invention, the height of the weld bead with only one five-tenth (1/15) to a twenty-fifth (1/25) of the diameter of the shaft dimensioned (claim 7). The height of the weld bead is with a fillet weld with the radius them limiting Viertellüeises defined.

To the thermal and metallurgic improvement the weld seam is not favourable it, sofeme MIG weld performed will, to make the weld (TIG, plasma or laser weld) bottom protective gases and with supply of a cold filler wire (claim 8) and with certain basic materials, the weld with supply of an austenitic filler wire (claim 9). The cold filler wire the reduced heat input. That is however possible only if the filler wire is not, as live with the MIG Verfaluen. The austenitic filler wire works gefügeverbessemd.

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TIG or the Plasmascllweissen comes to the use, if is to become connected with undivided housing the corotating mechanical component in the housing with the already incorporated shaft, because with these methods no welding splashes develop. Particularly favourably thereby a pulsed Schweissshom can be attained around lowest possible heat input with good penetration.

In a particularly favourable practice of the invention on a balancer shaft of an internal combustion engine, whereby the member is a balance weight with eccentric center of gravity, it exists in the fact that the weld at that is the center of gravity of opposite side of the shaft disposed (claim 10). On this side the mating surface of the element becomes pressed by the centrifugal force on the shaft, which results in a favourable tensile state.

One fi. mktionell and technically particularly favourable construction consists of the fact that the balance weight is an eccentric ring with two front surfaces and a cutout with two inner front surfaces at that the center of gravity of opposite side of the shaft, so that it consists with each other directed inner surfaces of two ring members on both sides the cutout and of a segment part on the side of the eccentric emphasis (claim 11). With this shape of the balance weight a maximum at eccentricity of the emphasis becomes achieved with a minimum at total mass. Thus four and two parallel planar surfaces for the welding en connection, lain lain transverse to the axis of the shaft, to the axis, stand for order, two lain of the crosswise only over a part of the circumference also for the connection in the extreme case.

A favourable solution consists of the fact that the weld beads are only disposed at the inner oh-normal inner surfaces (claim 12). They stress there practical no building area and are at a location of the shaft, at which they do not stand for bottom voltage by the supporting effect them of the ambient balance weight.

A particularly beautiful solution consists of the fact that the weld beads at the inner oh savings alleles are inner surfaces disposed (claim 13) and their two each other diametric face (claim 14). Thus eventual warm courses are centric-symmetric and waive each other.

In the following the invention becomes explained on the basis images described and. Represent:
Fig. 1 : A longitudinal section by the invention article,
Fig. 2 : A cross section after B-B in Fig. 1,
Fig. 3 : A cross section after B-B in Fig. 1 in a variant,
Fig. 4 : A cross section by first other embodiment of the invention analogous Fig. 2,
Fig. 5 : A cross section by second other embodiment of the invention analogous Fig. 2,
Fig. 6 : A plan view on the subject matter of the Fig. 1 in another Ausmhrungsform,
Fig. 7 : A variant to Fig. 6.

In Fig. 1 and Fig. 2 is a shaft with 1, their rotation axis with 3 and a driving member with 2 designated, fixed on the shaft 1. The shaft is here a balancer shaft, the driving member a balance weight, which is 1 mounted on the cylindrical seating surface 4 of the shaft.

In addition, the shaft 1 is here enlarged over its whole length cylindrical, could on a side of the element remote and in the diameter be, so that it has there a larger cylindrical seating surface 4 '.

The member 2, here a balance weight, has two outer surfaces 6 and itself only a cutout 7 extending over a part of its circumference, which form two inner front surfaces 8. This Stimflächen lies generally transverse to the axis 3, in the special case normal to it. Between the surfaces 6.8 and the cylindrical seating surface 4 of the shaft so a rectangular groove formed, which offers itself to the weld, becomes. The surfaces 6.8 do not have to be oh-normal; it is sufficient that their production with the seating surface 4 of the shaft an angle includes, which is in the order of magnitude of a right angle. In most cases are the flat planes.

The balance weight 2 consists 10 with azentrischem center of gravity 11 of two ring members 9 and a segment part. The two ring members with the cutout 7 located between them form thus a " suspender ", which holds the segment part of 10 in the operation against the centrifugal force. The balance weight 2 has a cylindrical seating surface 12, which fits for example with slide fit on the cylindrical seating surface 4 of the shaft.

The shaft consists here of a heat treatable steel, a for example of recompensed 42 CrMo4, hardened or case-hardened, which are not weldable bottom normal circumstances good. Welding parts with hardened structure requires usually special measures, for example special welding agents. In addition, the balance weight 2 consists here of forged case-hardening steel, for example C 15, could from cast steel or nodular cast iron (z. B. GGG40) exist.

The determination of the balance weight 2 on the shaft 1 one weld bead each becomes 20 placed at the two inner surfaces 8. This runs from a starting point 21, which Anfangskrater, over a curvature 22 in an elbow part 23, which represents the actual weld seam, again over a curvature 22 to an endpoint 21 ', Endl more ater. The height of 24 of the weld bead 20, here in the Winkelsymmetralen of the welded surfaces measured, can be small. Them amount to for example with a wave diameter of 25 millimeters 1.3 millimeters. By this only thin weld bead the workpiece also only little warm one becomes supplied.

Fig. 3 is a variant of the Fig. 2, which differs from this only by the fact that the weld bead 30 between Anfangs-und Endkrater 31, 31 ' rectilinear runs. The weld seam is then only the zone 33, in which the weld bead 30 concerns the shaft 1.

Fig. an other application example shows 4. On the shaft 1 an hub 42 sits. To the their connection two each other opposite weld beads are 40 provided, their course in the Fig. resembles 2 represented. The advantage of the symmetrical arrangement of the weld beads regarding eventual thermal lag lies on the hand.

Fig. the attachment of a gear 52 finally shows 5 on a shaft 1 as application example. Here three rectilinear weld beads are 50 provided, their Anfangskrater 51 and Endkrater 51 ' again only on the gear 52 lie, off the shaft 1. A weld according to invention can become at all front surfaces performed, in the present instance thus also on the side of the gear 52 invisible in the image. If it is case-hardened, it should be carburize-free in the range the weld seam.

The weld becomes preferably performed in the TIG or MIG method bottom protective gas, whereby becomes supplied during the example-wise combination of material a austhenitischer filler wire. In the sense of a minimization of the heat input the filler wire should not become cold, thus preheated, supplied.

Fig. another embodiment of the weld at the example of the balancer shaft of the Fig shows 6. 1, the here however not cut, but in view shown is. This other embodiment can do alternative or additional to that the Fig. 1 inserted become.

The cutout 7 rectangular in the development is of the two inner surfaces 8 in oh-normal planes and two other inner surfaces 60 in oh savings alleles planes limited. Also these two surfaces 60 form grooves, which take up one weld bead each 61 in this embodiment with the seating surface of the shaft. This runs from a Anfangslçrater 62 in a Ausrundung 63 to the straight portion, that the weld reestablishes and in a Ausrundung to the Endlçrater 624. The two Rater 62.62 ' lie again only on the inner surfaces 60 of the balance weight 10. In the variant of the Fig. 7 the weld bead 71 from the Anfangskrater 72 in an arc, preferably a circular arc, to the Endkrater 72 runs '. The arcuate weld bead manufactures 71 over a length 74 the connection between shaft and balance weight.

The described welder connections have exceptional good endurance limit values in experiments with undeminished run precision of the shafts achieved.